PATENT ABSTRACTS OF JAPAN

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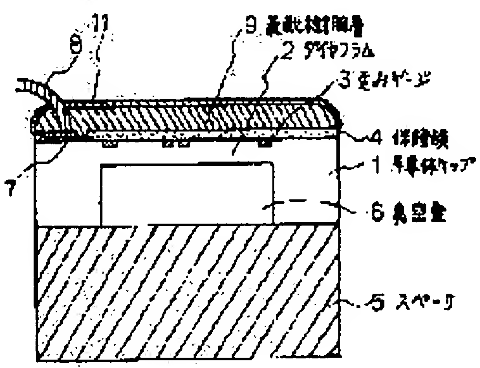
(54) SEMICONDUCTOR PRESSURE SENSOR

(57)Abstract:

PURPOSE: To prevent the characteristic change due to the arrival of contaminant such as moisture from a pressure medium at a strain gage formed on the surface of the diaphragm of a semiconductor chip 1.

CONSTITUTION: A strain gage 3 forming surface is covered with an insulating protective film 4 made from silicon oxide or silicon nitride, and laminated with a polymer material film 11 like waterproof fluorine resin or poly-para- xylene through a flexible resin layer 9 for transmitting pressure without change to prevent the moisture or other contaminant.



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CLAIMS

[Claim(s)]
[Claim 1] In that by which the strain gage of two or more second electric conduction forms was formed in the surface layer by the side of the anti-crevice of the diaphram section of the semi-conductor element assembly of the first electric conduction form where the crevice which leaves the diaphram section of thin meat to the whole surface side of a center section exists in a side on the other hand The semiconductor pressure sensor to which an insulating protective coat is formed in the front face of the diaphram section, and the protective coat is relatively characterized by being covered with the polymeric-materials film which is relatively hard and is rich in waterproofness through a soft resin layer.

[Claim 2] The semiconductor pressure sensor according to claim 1 which a semi-conductor element assembly becomes from silicon, and an insulating protective coat becomes from either silicon oxide and silicon nitride.
[Claim 3] Claim 1 which a soft resin layer becomes from gel resin relatively, or a semiconductor pressure sensor given in two.
[Claim 4] Claim 1 which a soft resin layer becomes from silicone resin, an epoxy resin, or the acrylic resin relatively, or a semiconductor pressure sensor given in two.
[Claim 5] The semiconductor pressure sensor according to claim 1 to 4 which is the fluororesin film with which the polymeric-materials film which is rich in waterproofness was formed by dip coating.
[Claim 6] The semiconductor pressure sensor according to claim 1 to 4 which is the poly PARAKISHI lane film by which the polymeric-materials film which is rich in waterproofness was formed with vacuum deposition.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the semiconductor pressure sensor which detects a pressure by the change in resistance of two or more strain gages formed in the diaphram which consists of a semiconductor material of the diffusion process.
[0002]
[Description of the Prior Art] The above semi-conductor pressure sensors are detected by leading pressures of the gas which may contain moisture and a contaminant, such as a pressure of the intake manifold section of atmospheric pressure or an automobile, to the field in which the strain gage of diaphram was formed. The cross-section structure of the semiconductor-pressure-sensor chip for absolute-pressure detection conventionally used for drawing 2 is shown. Diaphram 2 is formed in the center section of the N type silicon chip 1 with a thickness of 0.3mm on 3mm square, and the strain gage 3 which becomes the front face of the diaphram 2 from a P type diffusion layer is distributed. In order to protect this strain gage forming face, the laminating of the protective coat 4 which consists of silicon oxide, silicon nitride, etc. is carried out. The periphery of a chip 1 can do the vacuum chamber 6 which anode plate junction was carried out in the vacuum at glass or the spacer 5 with a height [made from silicon] of 1-2mm, and was surrounded with the chip 1 and the spacer 5 as the result. Diaphram 2 deforms by the differential pressure of the pressure and vacuum chamber 6 which join a chip gage forming face, i.e., absolute pressure, a gage resistance value changes, and it operates as a sensor which outputs the electrical signal which is equivalent to absolute pressure as a result. The aluminum pad 7 is formed in a chip side, and an electrical signal is drawn out outside by the bonding wire 8. In order to protect the aluminum pad 7 and a chip side from a foreign matter or moisture furthermore, the laminating of the resin layer 9 is carried out. Sufficiently soft resin is chosen as this resin layer 9 so that deformation of the diaphram 2 by the pressure 10 may not be affected from the upper part.
[0003]
[Problem(s) to be Solved by the Invention] Although this structure is the simplest structure as a pressure sensor, since soft resin 9 is not the precise matter, when moisture and moisture are contained in the pressure medium so much, if exposed to long duration moisture or moisture, the moisture which penetrated resin 9 will arrive at a chip side. As a result, the aluminum pad 7 corroded, and there was a problem of changing the resistance of the gage 3 under a protective coat in the static electricity-operation by the charge generated on the protective coat 4.
[0004] The purpose of this invention solves an above-mentioned trouble, and offers the semiconductor pressure sensor which prevents moisture, the gas which does a bad influence in addition to this, and a liquid arriving at a chip front face, and is equal to it also at the use under a severe environment.
[0005]
[Means for Solving the Problem] In the semiconductor pressure sensor by which the strain gage of two or more second electric conduction forms was formed in the surface layer by the side of the anti-crevice of the diaphram section of the semi-conductor element assembly of the first electric conduction form

where the crevice where this invention leaves the diaphram section of thin meat to the whole surface side of a center section exists in a side on the other hand in order to attain the above-mentioned purpose The insulating protective coat was formed in the front face of the diaphram section, and relatively, through the soft resin layer, the protective coat should be relatively hard and should be covered with the polymeric-materials film which is rich in waterproofness. It is good for a semi-conductor element assembly to consist of silicon, and for an insulating protective coat to consist of either silicon oxide and silicon nitride. It is good for a soft resin layer to consist of gel resin relatively, or to consist of silicone resin, an epoxy resin, or the acrylic resin. It is good that it is the fluororesin film with which the polymeric-materials film which is rich in waterproofness was formed by dip coating, or is the poly PARAKISHI lane film formed by vacuum deposition.

[0006]

[Function] The liquid or gas containing the bad influence of the moisture which invaded from the outside, and others is relatively hard, and the polymeric-materials film with waterproofness is not passed. For example, the water absorption of a fluororesin is 0.01% or less, and is 1/10 or less [of the water absorption of silicone resin / 0.1 - 0.3% of]. Therefore, the amount of the moisture to which the film which consists of an ingredient with such small water absorption reaches an insulating protective coat by being located on the front face which touches the pressure medium of the diaphram section is fully stopped. Moreover, generally, polymeric materials of chemical resistance are good, for example, in the case of a fluororesin, do not deteriorate to organic solvents, such as acids, such as chlorine and fluoric acid, and trichloroethylene, an acetone. Moreover, as compared with soft resin, the gaseous permeability of hard polymeric materials is also low. And since the thermal stress by the difference in the coefficient of linear expansion of polymeric materials and a protective coat ingredient is eased by pinching the soft resin layer between the polymeric-materials film and a protective coat relatively, exfoliation of the polymeric-materials film and fluctuation of a gage resistance value are prevented. Since the thin polymeric-materials film is only added on a soft resin layer, the attainment to the diaphram section of the pressure of a pressure medium is not checked.

[0007]

[Example] Drawing which gave the same sign to drawing 2 and a common part hereafter is quoted, and the example of this invention is described. The polymeric-materials film 11 which has waterproofness on the protective coat of the conventional semiconductor pressure sensor shown in drawing 2 is covered with the example shown in drawing 1 comparatively thinly. As these polymeric materials covered, even if thickness, such as a fluororesin and the poly PARAKISHI lane, is comparatively thin, the ingredient which has waterproofness is chosen.

[0008] It is drawing 3 about the membrane formation approach of these waterproof polymeric materials. (a) - (c) It is shown. the chip 1 which already carried out the laminating of the soft resin layer 9 -- the liquefied fluororesin 22 in the processing tub 21 -- being immersed -- [drawing 3 (a)] -- subsequently to an arrow head 23, liquefied resin 22 is shown -- as -- vacuum suction -- carrying out -- discharging -- [drawing 3 (b)] and [drawing 3 (c)] which it heats [ ] within a heat treating furnace 24 further, and stiffens the fluororesin film 11. In the case of poly paraxylene, the polymeric-materials film 11 is formed by vacuum evaporationo. These waterproof polymeric-materials film is comparatively hard, and since coefficient of linear expansion differs from the silicon of a semiconductor chip 1, the silicon oxide of a protective coat 4, or silicon nitride, a bad influence, such as separating in an interface, if a laminating is carried out on a direct protective coat, or changing a gage resistance value with thermal stress, produces it. It serves as shock absorbing material that the comparatively soft resin layer 9 intervenes between the polymeric-materials film 11 and the chip protective coat 4. Therefore, gel resin, such as silicone gel or epoxy gel, or comparatively soft silicone formal resin, an epoxy resin, acrylic resin, etc. are used for resin 11. In order to give the function as shock absorbing material, thickness of the resin layer 9 is set to 50-200 micrometers which removes the effect of the stress from the hard waterproof polymeric-materials film 11.

[0009] Although the example of the above this invention is the case of the semiconductor pressure sensor of an absolute-pressure mold, it can apply this invention also in the semiconductor pressure

sensor of a phase counter pressure mold which detects the difference of the pressure which joins both sides of diaphram for protection of the strain gage forming face of a chip.

[0010]

[Effect of the Invention] Since invasion of the pollutant which affects the resistance of the strain gage of the other moisture and diaphram section by covering the insulating protective coat of the diaphram section front face of a semiconductor pressure sensor by the waterproof polymeric-materials film through the soft resin layer which does not influence transfer of a pressure was prevented according to this invention, the usable semi-conductor pressure sensor was obtained also under the severe environment.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view of the semiconductor pressure sensor of one example of this invention
[Drawing 2] The sectional view of the conventional semiconductor pressure sensor
[Drawing 3] Polymeric-materials film membrane formation process of the semiconductor pressure sensor of one example of this invention (a) Or (c) Sectional view shown in order
[Description of Notations]
1 Semiconductor Chip
2 Diaphram
3 Strain Gage
4 Protective Coat
5 Spacer
6 Vacuum Chamber
9 Flexible Resin Layer
11 Waterproof Polymeric-Materials Film

[Translation done.]

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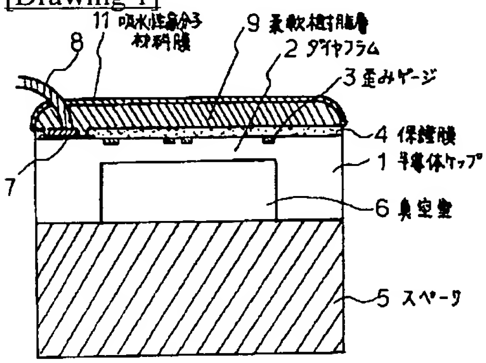
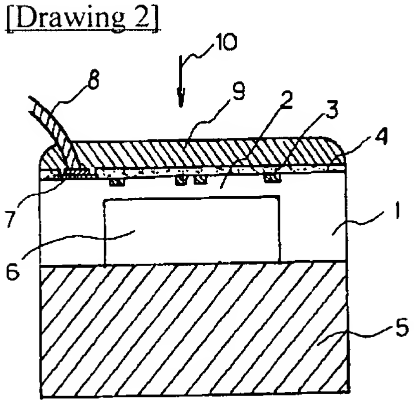
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

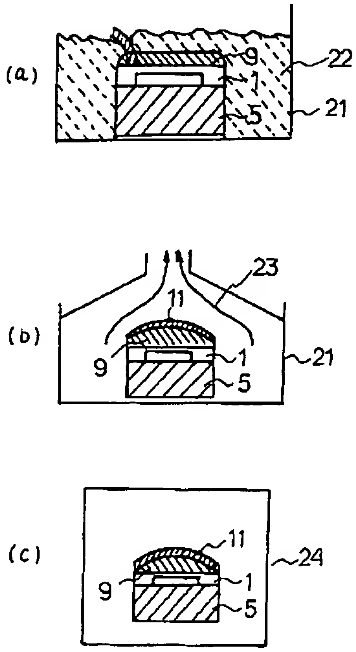
[Drawing 1]



[Drawing 2]



[Drawing 3]



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